A Bumpy Road and a Bridge too Far?

An Analysis of the Realistic Bridging and Horizontal Construction Capabilities of the Canadian Military Engineers in the Force 2013 Structure

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Abstract

This monograph analyzes the combined effects of changes in engineer training curriculum, adjustments to priorities in vehicle replacement programs, shortages of equipment, and disproportional combat engineer versus integral combat service support growth on the mobility capacity of the Canadian Military Engineers within the proposed Force 2013 structure. Using a modified PRICIE (akin to DOTMLPF) process, the mobility capacity of the current Canadian Military Engineer structure is determined. Finally, the current mobility capacity is evaluated against the requirements of Canada's National Defence Strategy, domestic contingency plans, current Army operating plan, likely future threat scenarios, and historical missions. The research exposes shortfalls in the capacity of the proposed engineer structure to provide mobility to Force 2013. Specifically in the areas of horizontal construction (roads), military bridging, and integral combat service support capabilities at the regimental level.

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Introduction

The Canadian Army has emerged from the "decade of darkness"[1] and completed its nine-year combat mission in Afghanistan. In 2011, the Canadian Army shifted its mission focus in Afghanistan from combat operations to training Afghan security forces while it repatriated new enabling capabilities generated specifically for combat in the Afghanistan theatre of operations. This marks a period of transition from the Army of Today to the Army of Tomorrow with a view to becoming the Army of the Future.[2] In response to this dual requirement to transition towards the future and integrate new combat enablers back into the force generating structure, the Commander of the Canadian Army, Lieutenant-General Peter Devlin, directed the Force 2013 initiative. Force 2013's purpose is to address the realities of the past decade and place the army on a stable platform from which to advance to the future.[3] The Force 2013 initiative is the Canadian Army's effort to transform the current force generation structure in order to integrate the new capabilities and equipment repatriated from the force employment structure in Afghanistan. Concurrently, the Canadian Army must maintain steady progress towards its future goal of transitioning to the Army of Tomorrow structure by 2021.

The Canadian Forces use a Capability Based Planning (CBP) approach to create its force structures, which generate necessary future capacities. A review of available Directorate of Land Concepts and Design records indicates that the CBP process was truncated, incomplete, or not conducted at all for the developed Engineer Route Opening Capability (EROC) and Counter-Improvised Explosive Devise (CIED) combat enabling capabilities and equipment purchases for

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[1] General Rick Hillier, *A Soldier First: Bullets, Bureaucrats and the Politics of War* (Scarborough: Harper Collins Canada, 2009), 123. The Decade of Darkness is explained in more detail in the background section. It was a period of punishing cuts in defence spending combined with exponential growth in operational deployments throughout the 1990s.

[2] Canada Department of National Defence (C-DND), *Future Force: Concepts for Future Army Capabilities* (Kingston: Directorate of Land Strategic Concepts, 2003).

[3] Lieutenant-General Peter Devlin, "Army Futures," *The Canadian Military Journal* 11, no 1 (Winter 2010).

use in Afghanistan.[4] The incomplete CBP process did not follow through the final steps and properly adjust the current force generation system, in Canada, to produce the deployed capabilities. As a result, the Canadian Army will likely experience difficulties reverse engineering their integration in the Force 2013 initiative.

More specifically, in order to meet capability demands of the unique force employment structure in Afghanistan, the Canadian Military Engineers (CME) executed changes to force generation structures and programs in Canada without the benefit of the final steps in the CBP process and without applying the complete PRICIE framework analysis.[5] The CME changed the curriculum focus for the individual training programs in the engineer branch, adjusted priorities on equipment replacement programs, and grew engineer end strength in its combat engineer regiments without corresponding increases to its integral service support elements. The ramifications of these actions are most notable in the CME's ability to provide land force mobility, particularly bridging and road construction. This monograph seeks to define the combined effects of these changes on the mobility capacity of Canadian Military Engineers within the Force 2013 structure and discuss their overall ability to meet likely future requirements.[6]

In order to focus the topic, this monograph will address ground-based mobility and will not include air or airmobile assets of the Royal Canadian Air Force. Furthermore, this discussion will not explore Force 2013's specialization of the Canadian Army's three brigades into

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[4] C-DND, *Capability Development Report – 07012, CIED* (Ottawa: Chief of Land Staff, 2007), 13 and Major Steven Bramhall (Directorate of Land Concepts and Designs in Kingston, ON) to Major Chris Swallow, personal email communications (31 October 2011).

[5] PRICIE (Personnel, leadership and individual training; Research and Development, and operational research; Infrastructure, environment and organization; Concepts, doctrine and collective training; Information management and technology; Equipment and support). PRICIE is akin to the U.S. Army DOTMLPF process.

[6] C-DND, *Military Engineer Support to Canadian Forces Operations* (Ottawa: Government of Canada, 1999), 1-4. Mobility defined as the ability of air, land and sea forces to move and to conduct operations throughout the theatre at will.

mechanized, air mobile, and jungle/littoral brigades. Nor will this monograph consider budgetary limitations. This paper assumes that the essential land mobility requirements of the three specialized brigades will be, for the most part, similar. The individual training of personnel, equipment and support aspects (P&E/S) of the PRICIE framework will form the basis for the critical analysis.

There are three sections in this discussion. Chapter I will realistically quantify Force 2013's mobility capabilities by using a modified PRICIE framework analysis (only the personnel, equipment and support – P&E/S - aspects) and the characteristics of military engineering support. Chapter II will discuss what the Government of Canada (GoC) and Canadian Department of National Defence (DND) requires Force 2013 to accomplish. Finally, Chapter III will compare expected future threat scenarios against the historical requirements of Canada's contributions to the 2010 Haitian humanitarian assistance and Newfoundland's 2010 Hurricane Igor recovery missions in order to determine likely future requirements and highlight gaps in Force 2013 capabilities. The conclusion of each chapter provides a summary of the recommendations for changes in the Canadian Military Engineer (CME) aspects of the Force 2013 force generation structure.

The goal of the monograph is to determine if the Canadian Army's Force 2013 initiative exposes a shortfall in engineer capacity to provide the Canadian Army mobility given a P&E/S framework analysis of the Force's realistic engineer horizontal construction and military bridging capabilities, an operational review of Canada's strategic demands, and its likely future requirements. The research indicates that the Canadian Army sacrificed its mobility capabilities to sustain force generation for the war in Afghanistan. There is evidence of degradation in the Canadian Military Engineers' operational ability to execute horizontal construction and military bridging. This reduction in engineer core skills has a direct impact on prospective Canadian Army missions. The mobility capabilities of the Canadian Army's Force 2013 engineer structure are insufficient to meet the expected future requirements due to the reality of technical skill erosion

in its personnel, a combination of antiquated vehicles, lack of critical bridging resources, and an inability to provide the necessary combat service support to maintain engineer horizontal construction and military bridging operations.

Background – What has led to the Canadian Army of Today?

In order to understand the Canadian Army's future direction and its tendency to focus on short-term goals, it is important to understand the background behind the changes in the Canadian Forces (CF) since the early 1990s. Despite its active role in modern operations, the CF was on the brink of organizational collapse at the turn of the 21st century. It had lost the confidence of the public and successive, deficit-slashing governments pillaged the defence budget. It invoked a survival instinct in the institution and fostered an operational mindset of "doing more with less." The CF's understanding of the "do more with less" philosophy is rooted in over forty years of organizational decline dating back to Unification in 1968.[7] This continual erosion achieved a pinnacle of public apathy and continuous government imposed reductions in the 1990's resulting in what General (retired) Rick Hillier referred to as the "decade of darkness."[8]

The downward organizational spiral included public outcry over an incident in which Canadian military members tortured and killed a Somali teenager during the 1993 African peacekeeping mission. After the spotlight of public inquiries dimmed, the perception of widespread disciplinary problems led to the Canadian government's decision to disband the Canadian Airborne Regiment.[9] The incident destroyed the CF's credibility and both the Canadian government as well as the general public marginalized the CF.[10]

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[7] Idris Ben-Tahir, "Decade of Darkness," *The Ottawa Citizen*, 5 March, 2007; Canada, Parliament of Canada-Senate, *Four Generals and an Admiral: The View from the Top*, (Ottawa: Government of Canada, 2008).

[8] Hillier, 123.

[9] Ibid., 121.

[10] Ibid., 123.

The minimization of the CF continued with massive budget cuts in 1994. This amounted to a 25 percent reduction in defence spending, and resulted in further personnel cuts, force reduction programs, four major base closures, and the elimination of two out of the three Canadian military colleges. From 1990-1997 the number of CF personnel shrank from 87,000 to 61,000 (-30 percent) and the Defence budget was slashed from $17 billion to $12.1 (- 29 percent).[11] During the same timeframe, the CF had five Chiefs of Defence Staff (CDS) over the four year period from 1993-1997. The CF fought for survival against the onslaught of personnel reductions and budget cuts while simultaneously lacking a long-term vision due to the rapid turnover of its strategic leader, the CDS, which combined with post Cold War global uncertainty.

Concurrent with these issues, the number of CF international operations increased from eight in 1990 to twenty-six in 1997 (+325 percent).[12] The Government of Canada's (GoC) operational requirements placed on the Canadian Army ignored a decade of budget cuts and its expectations of the military grew exponentially to satisfy foreign policy demands. The Canadian Army deployed in the 1990s with outdated vehicles and equipment never intended for combat.[13] To reduce procurement budgets, Canada purchased fleets of inexpensive training vehicles to replicate their more expensive combat machines. For example, the wheeled Cougar vehicle was an armoured vehicle, crew trainer replacement for the costly main battle tank. Despite their design exclusively for training purposes, these vehicles deployed on operations in Bosnia during the 1990s.

The Canadian Army resembled an over-stretched, worn-out rubber band that continually

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[11] Stockholm International Peace Research Institute, *Facts on International Relations and Security Trends-2010*, http://first.sipri.org/search?country=CAN&dataset=armed-forces&dataset=cfe-ceilings-and-holdings&dataset=military-activities&dataset=military-expenditure (accessed October 20, 2011).

[12] Canadian Forces Department of History and Heritage, *CF Operations Database 2011*, http://www.cmp-cpm.forces.gc.ca/dhh-dhp/od-bdo/sr-rr-eng.asp (accessed October 20, 2011).

[13] Hillier, 114.

expanded to meet enormous operational demands.[14] The Canadian Army mastered the ability to do more with less in order to meet the operational demands and developed a habit of piecemeal procurement, with whatever available funds, to meet immediate operational needs. The Canadian Forces pressured the government to provide a small number of items needed immediately for a specific operation but the political climate never provided the direction, or the desire, for long-term institutional plans and procurement. The Liberal government of the 1990s viewed the military as a necessary evil and the budgetary relationship resembled an image with the military holding a begging bowl hoping for donations for their overseas missions.[15]

The Canadian Army continued to respond effectively, both at home and abroad in the late 1990s, despite its relatively small size in comparison to its peers.[16] Canada's former CDS, General Rick Hillier, identified the Army's centre of gravity during this period as its credibility.[17] Strong performances during domestic humanitarian operations, such as the 1997 Manitoba floods, 1998 ice storms, and 2003/5 British Columbia forest fires, sees the Army reconnecting with Canadians to restore its credibility in the eyes of the public. Post 9-11 participation in the Afghanistan conflict has reveals a more modern Canadian Army after an introduction of new equipment and capabilities; however, organizationally the Army still struggles to meet the demands placed upon it by government. To put it in perspective, in 2004 Canadians spent $2 billion more on alcoholic beverages than they did on their military.[18] This cycle of over-commitment and under-funding forced the Canadian Army to take an operational pause from

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[14] Canada, Parliament of Canada-Senate, *Wounded: Canada's Military and the Legacy of Neglect*, (Ottawa: Government of Canada, 2005), 6.

[15] Canada, Parliament of Canada-Senate, *Turmoil: The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change*, (Ottawa: Government of Canada, 2006), 69.

[16] Hillier, 129.

[17] Ibid., 126.

[18] Canada, Parliament of Canada-Senate, *Wounded*, 10.

August 2004 until February 2006 in order to fix its exhausted and broken organization.[19]

The CF strategy has defaulted to doing the best it can within limited resources rather than establishing the conditions for long-term institutional viability and resourced capabilities that satisfy expected operational demands. Now the question, after decades of short-term procurement policies, is what are the Canadian Army's realistic capabilities and do they support the national security strategy? Liddell Hart describes this difficult challenge faced by all socially conservative states. They must find the type of strategy that is suited to fulfill limited political objectives in the most strength conserving way, while still ensuring the state's future as well as its present.[20] The Canadian Army's organizational strategy must learn to merge future needs with the present internal structure to yield the capabilities required to achieve policy objectives using a coherent planning process. The Canadian Army has chosen the Capability Based Planning process to accomplish this objective.

Roadmap to the Future – The Capability Development Process

An understanding of the definition of capability is integral to the discussion of the capability development process. A military capability is the combination of a number of force elements, at designated states of readiness for employment on operations, in order to achieve tactical and/or strategic effect against an opponent. This capability must reside within the framework of force preparation, deployment, sustainment, and operational command. These capabilities include a robust mix of people, training, equipment, logistics, and structure that are all working towards a unity of effect to deliver fighting power.[21] The process of coherent military

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[19] Canada, Parliament of Canada-Senate, *Turmoil*, 8.

[20] B.H. Liddell Hart, *Strategy*, (London: Faber & Faber Ltd, 1954/67), 355.

[21] Charles Morrisey, *A CF Strategic Capability Planning Process*, (Kingston: Department of National Defense, 2009), 4. This is the United Kingdom Directorate of Land Warfare definition of military capability as described by Charles Morrisey in his discussion on the Canadian Forces Capability Planning Process.

capability development has begun for the CF. The Canadian Army is designing its Army of Tomorrow through a review of prospective concepts and systems in order to develop the future force structure.

To assist in developing its long-term force structure planning process, Canada is a member of The Technical Cooperation Program (TTCP) and strives to adopt a capability-based planning (CBP) approach.[22] TTCP's definition of CBP is "planning under uncertainty, to provide capabilities suitable for a wide range of modern-day challenges and circumstances while working within an economic framework that necessitates choice."[23] TTCP describes the CBP process as a method that involves a functional analysis of operational requirements. The process develops effective, integrated capability packages to meet the assessed future threats to Canadian national security and interests. This comprehensive analysis reviews all aspects of PRICIE to develop the appropriate capability requirements and integrate them properly into Army force structures. The CBP approach emphasizes proper analysis of future needs vice simply focusing on choosing attractive equipment to purchase. It matches capabilities to future requirements and adjusts force generation structures to sustain them in the long-term.

The Canadian Army did not heed this process in the past decade. It continued its pattern of piecemeal equipment procurement and theatre specific capability development when responding to urgent combat requirements in Afghanistan. Throughout operations in Afghanistan, elements of the CBP approach and a truncated PRICIE analysis created new capabilities and purchased unique equipment at the request of deployed forces. Owing to the upcoming cessation of Canadian combat operations in Afghanistan, the Canadian Army has been repatriating these

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[22] Technical Cooperation Program, *Guide to Capability Based Planning*, (Washington: Joint Systems and Analysis Group, 2003), 3. *Capability* defined in the *TTCP Guide to Capability Based Planning* as the ability to achieve a desired effect under specified standards and conditions through the combination of means and ways to perform a set of tasks.

[23] Paul Davis, *TTCP Guide to Capability Based Planning*, (Washington: Joint Systems and Analysis Group, 2003), 1.

new, theatre-generated combat enablers and must now integrate them into the permanent force generation structure. In response to this integration requirement, the Commander of the Canadian Army, LTG Devlin, directed the Force 2013 initiative. The Force 2013 initiative is the Canadian Army's effort to transform the current force generation structure to integrate the new capabilities and equipment repatriated from the force employment structure in Afghanistan.[24]

A review of available records indicates that the CBP process was truncated, incomplete or not conducted at all for many of these developed force employment capabilities and equipment purchases for use in Afghanistan. For example, the incomplete PRICIE analysis for the Engineer Route Opening Capability (EROC) did not follow through the final steps and adjust the current force generation system to produce the deployed capabilities.[25] As a result, the Canadian Army will experience difficulties reverse engineering their integration. More importantly, in order to meet force employment demands in Afghanistan, the Canadian Military Engineers (CME) executed changes to force generation programs in Canada without the benefit of the final steps in the CBP process and applying the proper PRICIE framework. Uncoordinated changes occurred in engineer individual training programs at the Canadian Forces School of Military Engineering (CFSME), equipment procurement/replacement programs, and combat service support capabilities at the unit level.

The CF's creation of a Counter-Improvised Explosive Device (CIED) capability is an example of this lack of coordination while making changes in the Canadian Army. CF force developers responded to an Afghanistan theatre demand for the CIED capability and commenced a PRICIE analysis to create that capability from resources currently available in the national force generation structure. The task to create the capability fell upon the Canadian Military Engineers.

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[24] Lieutenant-General Peter Devlin, "Army Futures," *The Canadian Military Journal* 11, no 1 (Winter 2010), 45.

[25] C-DND, *Capability Development Report – 07012*, 13 and email communications with Major Steven Bramhall from Directorate of Land Concepts and Designs in Kingston, ON (31 October 2011).

Their abbreviated PRICIE analysis designed a plan to generate a CIED capability at the expense of curtailing road construction and bridging training in the engineer curriculum of career courses at CFSME.[26] Operational time constraints led to an incomplete PRICIE process. A tension arose because of the unfinished analysis into the future effects of changes in bridging and road construction training, which then translated to a degraded mobility capacity within the CME.[27]

The CME personnel training, equipment, and logistics issues resident in the mobility capability example portrayed the strains placed on the Canadian Army by the fiscal and force reductions of the decade of darkness. This produced a philosophy for rapid procurement of operational necessities in a specific theatre of operations vice the long-term provision of well-developed, integrated capabilities in a CBP approach. The philosophy manifested itself in an institutional willingness to sacrifice the future health of the Canadian Army to meet current demands. The combined effects of the changes have had a profound effect on the mobility capabilities of the proposed Force 2013 engineer structure. This is a serious shortfall when one considers the doctrinal importance of mobility amongst the key factors in an Army's ability to generate and project combat power.

Doctrine – The importance of the CME's Mobility Capacity

"It is a truism that the prime duty of the sapper is to enable the Army to move, and to keep moving. A large proportion of engineer effort in a campaign is directed to this end, bridging, mine clearance, and above all road construction."[28] Sixty years have not changed the core elements of land force mobility as described in the passage from the post-war British military

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[26] Major Paul Kernaghan (Officer Commanding Field Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (10 January 2012).

[27] C-DND, *Capability Development Report – 07012*, 13.

[28] R.P. Pakenham-Walsh, *Military Engineering (Field)*, (London: British Department of National Defence-The War Office, 1952) quoted in Canada, Department of National Defense, *Land Operations*, (Kingston: Department of Army Doctrine, 2008).

engineering manual. Canadian Land Force Engineer Operations ties the maintenance of superior mobility to manoeuvre as a means to compensate for numerical inferiority.[29] The Land Force Engineer Operations publication goes on to describe the importance of mobility in every operational environment and all types of military operations. Helicopters and other air transportation have provided modern alternatives to ground based travel, but they have limits in their total capacity and their ability to conduct operations in all weather conditions. Bridging and road construction are at the core of the fail-safe mobility capability for land forces.

Canadian Land Operations further explains the importance of mobility in an army's ability to manoeuvre and remain flexible. The five operational functions describe the functional capability of the land force with mobility providing the freedom of manoeuvre to act and to sustain.[30] The Canadian Army subscribes doctrinally to effects based operations applied at the tactical level through the manoeuvrist approach which is enabled through land force mobility.[31] Further, mobility enables the manoeuvre warfare principle of agility thus permitting a commander the opportunity to apply operational art and seize the initiative while dictating the course of operations by being able to apply combat power quicker than his opponent.[32]

Moreover, an understanding of the physical, moral, and intellectual components of fighting power explains how the changes made by CME affect mobility. The tangible elements of the Canadian Army's organizations, its equipment, and training in the physical component combine with the educational aspects in the intellectual component to show that the deficits caused by the CME's reduction of road and bridge construction training will lead to the

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[29] C-DND, *Land Force Engineer Operations Vol 1*, (Kingston: Department of Army Doctrine, 1998), 4.

[30] C-DND, *Land Operations*, (Kingston: Department of Army Doctrine, 2008), 4-18. Five operational functions are: command, sense, act, shield, and sustain.

[31] Ibid., 5-28.

[32] Ibid., 5-73.

ineffective application of combat power.[33] The CME decisions to reduce/eliminate bridging and road construction in core engineer training, adjust priorities on engineer equipment replacements, and failure to increase service support capacity with regimental growth are reducing the overall combat power of the Canadian Army. This brings the realistic engineer mobility capacity of Force 2013 into question, a situation which must be investigated.

Chapter 1: Force 2013 Horizontal Construction and Military Bridge Building Capabilities – What Can It Accomplish?

Introduction

At first glance, the Canadian Army's Force 2013 engineer structure appears to be a healthy organization with robust personnel manning, a wide variety of combat proven vehicles and engineer equipment combined with a combat service support package to maintain its operational readiness. A closer analysis of this structure reveals the sobering reality of its true shortfalls. A decade of Canadian Army focus on the war in Afghanistan has eroded the technical skills of the Canadian military engineers, reduced the availability of mobility resources, and created a hollow service support capability. Afghanistan force employment requirements demanded reductions in military engineer core training, changed vehicle replacement and bridging resource priorities, and overwhelmed combat service support capacity.

In order to understand some of the tensions present in the Force 2013's initiative to re-integrate Afghanistan theatre capabilities back into the Canadian Army's force generation structure, it is important to review the background and history, which led to the creation of these force employment capabilities in the first place. In CPB theory, a military organization adjusts its force generation structure to create the capabilities that it deems necessary to conduct operations in predicted future operating environments. This enables a military to sustain relevant, effective, and needed deployable capabilities in the long term and provides for a broad, flexible capacity to

[33] Ibid., 4-2.

respond to unexpected operational requirements. In Canada's case, operational timelines for Afghanistan forced the Army to sacrifice general engineer mobility capabilities in its force generation structure to focus on emerging requirements of force employment in Afghanistan.[34] Furthermore, some capabilities circumvented the normal adjustment process in the force generation structure and were rapidly fielded directly into employment in the Afghanistan theatre of operations.

CDR 07012 documents show that new capabilities, such as improvised explosive device disposal (IEDD) and engineer route opening capability (EROC), did not complete the entire PRICIE framework in a CBP approach during their creation.[35] Instead, operations in Afghanistan identified a capability gap. Then the Army purchased quick solutions and fielded them for immediate deployment to theatre. Their generation satisfied an urgent operational requirement (UOR), and partially circumvented the bureaucratic approval and funding problems associated with CBP changes to the force generating structure in Canada. Therefore, the existing force generation structure in Canada was never modified properly to create and then continue to sustain the theatre capabilities.

This brief background discussion explains how the existing Canadian Army force generating structure made both sacrifices in capabilities and uncoordinated changes in an attempt to develop and sustain Afghanistan force employment requirements demanded by the UORs. Sacrifices were made in the personnel, equipment/resources, and support (P&E/S) elements of the existing engineer force generating structure without a comprehensive plan, normally generated in the capability based planning (CBP) approach, and the subsequent first, second and third order

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[34] Major Paul Kernaghan (Officer Commanding Field Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (10 January 2012).

[35] C-DND, *Capability Development Report – 07012*,13.

effects of these decisions are not completely understood.[36] The Force 2013 initiative will not fix this issue. The focus of the Force 2013 plan was the integration effects of theatre-generated capabilities, not the deficiencies in the existing force generating structure.

During transition to the Force 2013 structure, the likelihood of directly transferring the unknown effects of these combined P&E/S changes, in the existing engineer force generation structure, to the new Force 2013 structure is very high. To gain an appreciation for the combined effects of the P&E/S changes in the existing force generating structure, this chapter discusses an operational assessment of the existing engineer horizontal construction and military bridging capabilities as they relate to Army mobility operations. The operational assessment used the characteristics of engineer support, found in Canadian Forces publication B-GG-005-004/AF-015 - Military Engineer Support to Canadian Forces Operations, to evaluate the P&E/S changes.[37]

The characteristics of military engineer support provide a useful framework to conduct an operational assessment of the realistic capabilities of the P&E/S aspects of the Force 2013 engineer structure. Specifically, the characteristics of *flexibility* and *skill* will be used to review the mobility training foundations of Canada's army engineers.[38] Engineer *skill* derives from individual, specialized core capabilities and trained supervision of tasks, while *flexibility* results

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[36] M. Lizotte et al, *Toward a Capability Process*, (Ottawa: Department of National Defence, 2005), 23. The Defence R&D paper describes the P&E/S elements well. Personnel element is the identification of the knowledge, skills, abilities and competencies required of personnel so that they are qualified to perform tasks as part of an expeditionary coalition military force. Equipment and Support element describes all capabilities including logistics, platforms, systems, weapons and related spares, repair parts and support equipment necessary to equip, operate, maintain and support coalition military activities. This includes transport, stock holdings, provisioning lead times, distribution, serviceability, and configuration states.

[37] C-DND, *Military Engineer Support to Canadian Forces Operations*, (Ottawa: Department of National Defence, 1999), 1-6. Characteristics of engineer support are flexibility, mobility, reliance on equipment and stores, skill, vulnerability, and limitations.

[38] Ibid, 1-6. Flexibility results from the training and organization of units/elements. It is the ability to regroup into the task-organized role of close or general support thus allowing for increased flexibility in planning. Skill is to operate complex equipment and complete specialized tasks. Engineers are highly skilled personnel requiring trained engineer supervision.

from that same training and the engineer organization's ability to re-organize quickly for either close or general support. The characteristics of *mobility* and *reliance on equipment/stores* assist in analyzing the Force 2013 heavy equipment, armoured engineer vehicle and bridging resources.[39] These second two characteristics combine to explain the necessity for engineers to plan, coordinate and control stores/equipment as well as retain adequate vehicles to transport these critical assets in the theatre of operations. Finally, the characteristic of *limitations* discusses the critical combat service support provided by maintenance and support elements.[40] Equipment failure and human fatigue amplifies engineer reliance on equipment and skilled personnel. Thus, provision levels of combat service support are a key factor in the limits of engineer capabilities. The highlighted characteristics of military engineer support; *flexibility, skill, mobility, reliance on stores/equipment, and limitations* provide a dual role as both a doctrinal standard for discourse on the realistic Force 2013 mobility capacities; in addition to serving as identifiable criteria in the comparison of realistic capacities to stated and likely future requirements.

The First Shortfall – Reduced Engineer Core Training of Personnel

Engineer operations require an effective combination of officers, senior non-commissioned officers (Sr NCOs), and sappers contributing to a task in order to succeed.[41] This provides *flexibility* and *skill* through a broad base of trained engineer skills and corresponding

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[39] Ibid., 1-5. Close support is the first organizational principle of employing engineer forces and refers to task organization of an engineer unit/element with specific resources to provided immediate engineer support (mobility, counter-mobility, and survivability) to assist the task force commander. General support is the second related organizational principle and encompasses a larger spectrum of the engineer unit/element to provide water supply, maintenance of MSRs, EOD and other engineer support to the force as a whole regardless of the location within the theatre of operations. Reliance on equipment and Stores – to provide flexibility of employment and successful completion of tasks requires centrally controlled, serviceable stores and equipment operated by skilled specialists.

[40] Ibid, 1-6. Limitations describes the reliance on equipment and personnel operability twenty-four hours a day is limited by equipment failure and personal fatigue. Maintenance time and support for both is necessary in every operation.

[41] Sapper is a historically significant name attributed to engineers and now associated in the Canadian military with the rank of Private in the engineer corps in the same vain as trooper in the armoured corps and bombardier in the artillery.

practical experience with a deliberate professional development program. Each rank level provides a specific element that combines the trained *skills*, learned experience, and supervision required for the safe and effective conduct of engineer mobility operations. All ranks train in the execution of these specialized *skills* and the leadership, both officers and Sr NCOs, receive further professional development training to aid in the design and supervision of these technical operations. The combined training and experience of all rank levels assists in planning as well as the resolution of difficulties during execution in order to provide organizational *flexibility*. Reductions in a particular area of expertise detract from the *flexibility* and *skill* of the overall force generation structure.

Prior to Afghanistan, the elimination of the infantry pioneer capability had begun to create tension in engineer *skill* focus. The requirement to replace the close support function of the pioneer capability, lost in infantry units, strained against the fulfillment of other technical engineer skillsets. Ultimately, force employment demands in Afghanistan changed engineer training priorities at the Canadian Forces School of Military Engineering (CFSME). For engineers, the Afghanistan theatre required increased proficiency in explosive ordnance and improvised explosive device disposal (EOD and IEDD) as well as improvements in overall infantry skills. Moreover, the terrain in Afghanistan was amenable to the manoeuvrability of the Army's vehicles. Therefore, rudimentary horizontal construction skills would suffice. Operational tempo necessitated an increase in engineer personnel production to satisfy force generation demands. Thus, operational tempo negated the option of prolonging time spent at CFSME for training and the Afghan terrain permitted further shift in allocation of training priorities at the school.[42]

Time was the critical factor and any increases in training allocations must have

[42] Major Paul Kernaghan (Officer Commanding Field Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (10 January 2012).

corresponded to equivalent decreases in other areas. The Army's decision to increase engineer *skill* levels in the areas of EOD, IEDD, and basic infantry skills required a decision to assume risk in other engineer skills. This led to CFSME's decision to reduce horizontal construction and bridging training. The Army's assumption of risk in the reduction of the technical engineer *skills* of road construction and bridging was an uncoordinated change in the existing force generation structure. The Canadian Army has not investigated the effects of these reductions in training. Their ramifications on the mobility capability of Force 2013 are the focus of this monograph's investigation of reductions in the core training of engineer personnel.

The engineer core training changes at CFSME centred on increasing throughput and explosive *skills* at the expense of horizontal construction and bridging. In the area of horizontal construction, CFSME removed classes on soils and road design, quarry operations, survey, and project management. These reductions, combined with the Canadian Army's decision to eliminate the field engineer equipment operator (FEE Op) sub-trade in 2001, created an exponential loss of horizontal construction capability. In bridging, CFSME reduced the overall types of bridges taught and time spent on construction practice by almost 75 percent, and it was also eliminated entirely from junior leader level courses.[43] Reviewing each of these reductions will determine their effects on engineer mobility capacities.

The reduction in horizontal construction capabilities discussion begins with the decision in 2001 to abolish the field engineer equipment operator trade (FEE Op) and amalgamate it with the field engineer trade to form a new combined combat engineer trade in the Canadian Army.[44] This amalgamation caused a significant loss in specialized horizontal construction skills and

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[43] Major Paul Kernaghan (Officer Commanding Field Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (10 January 2012). Only basic medium girder bridge and medium floating raft/bridge are taught with ACROW, advanced medium girder bridge types, Bailey, Mabey-Johnson, and non-standard bridges not taught in core training.

[44] C-DND, *Career Flow Analysis of the Proposed Combat Engineer Occupation*, (Ottawa: Directorate of Strategic Human Resource Coordination, 2001), 1

training time. The basis of the new combat engineer trade is the former field engineer trade with operation of heavy equipment and road construction reduced to single specialty courses. Despite the obvious losses in technical *skill*, force generation requirements rendered the equipment operator trade unsustainable, given the numbers of trained field engineers required in support of deployed operations. Amalgamation allowed greater *flexibility* for employment; however, the solution relegated the heavy equipment occupation from a trained, *skilled* career path to a vehicle qualification on par with any other military vehicle.[45]

Previously, a young sapper showing the ability to work heavy equipment received horizontal construction training and transferred to a specialized trade within the engineer branch. This sapper experienced normal career progression in this engineer specialty trade and ascended through a separate program to receive additional training in soils and eventually professional development in leadership roles for road construction and supervision of heavy equipment. The Canadian Army took significant risk eliminating this specialized trade. It lost all of the former heavy equipment operators for extended periods of combat engineer retraining, and cancelled horizontal construction training for a period of almost six years.[46] The only study undertaken focused on statistical career flow analysis for overall sapper production numbers and did not address any aspects of horizontal construction capability loss.[47] This trade elimination has a direct effect on the Canadian Military Engineer's ability to construct roads and provide mobility for the ground force.

Adding to the horizontal construction shortfalls, associated with the elimination of the FEE Op trade, was the decision to remove soils and road design, quarry operations, survey, and project management from the curriculum for officers and Sr NCOs. CFSME implemented

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[45] Ibid, 1

[46] Major Paul Kernaghan (Officer Commanding Field Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (10 January 2012).

[47] C-DND, *Career Flow Analysis of the Proposed Combat Engineer Occupation*, 1.

mitigation measures for the removal of these mobility instructional packages. The desire was to create specialty courses to teach a cross-section of unit leadership outside of their key career progression regime. The reality saw CFSME unable to establish the heavy equipment plans and operations course (HEPO) for almost a decade. Furthermore, CFSME still does not teach soils design and the HEPO course is not well attended. Separate rapid career progression issues also plague the junior leaders attending the course with limited heavy equipment operation experience.

The ultimate effect of this skill loss compounds at higher rank levels as leaders cannot recognize nor correct faults while leading tasks. The Canadian Engineers are now entering a second generation of leaders lacking these key technical mobility *skills* and the few remaining leaders, trained before 2001, have completed employment in operational units due to career progression.[48] The true difficulties with this loss of technical *skill* are hidden beneath the surface of Afghanistan. Focus on a single theatre of operations, where terrain is suitable for rough roads and combat vehicles, conceals the lack of technical horizontal construction skills resident in the Canadian Army. This technical *skill* fade is also present in Canadian Military Engineer bridging capabilities.

Concurrent with reductions in horizontal construction, CFSME reduced the total amount of time allocated and the number of different types of bridging methods taught.[49] Previously, engineers received a broad range of training on several types of standard military bridges as well as a number of foreign variants, civilian variants, and non-standard bridging (NSB) construction methods. Trained types included all aspects of medium girder bridging (MGB), Bailey, Acrow, Mabey Johnson, medium floating raft/bridge (MFR/B), and additional construction of custom designed NSBs. This ensured an extensive knowledge of likely types of bridging encountered on

[48] Major Paul Davies (Officer Commanding Reserver Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (12 January 2012).

[49] Ibid.

domestic and deployed operations. The reduction in training time for bridging means engineers now received only an introduction to MGB and MFR/B. This change in training priority has resulted in a 75 percent reduction in types of bridges taught, overall bridging time is reduced 75 percent, and the transfer of the training gap to the employing engineer regiments.[50]

The engineer regiments are also experiencing the same training priority pressures because of force generation requirements for continuous deployed operations. In contrast to CFSME curriculum, bridge training time at individual units is not standardized and is hence a mixed, lesser-known quantity. The unknown, varying degrees of bridging capability across the force generating structure severely limits the flexibility of planners and at the end of the day, the deployed employing engineer organization. The absence of bridge training, in its entirety, on junior leadership courses at CFSME creates a potentially dangerous knowledge gap in bridging small party commanders. These factors combine to increase the likelihood of accidents causing physical injury to personnel or un-necessary damage to critical bridging resources. Chapter 3 will discuss Operation LAMA and review the risks of technical bridging *skill* erosion in the Canadian Army.

The risk associated with the combined dilution of the bridging training, elimination of horizontal construction training, and abolishment of the FEE op trade grows over time. Canadian Military Engineer leadership explained these risks to Army leadership; however, their second and third order effects are only now becoming evident. Technical *skill* erosion significantly reduces the core mobility *skills* of the current combat engineer at all rank levels. Bridging is a key component of providing ground mobility across the spectrum of conflict. The cumulative effects of this change in the individual training for the past decade contribute to a 75 percent reduction in trained bridging *skill* and a loss of *flexibility* in the Personnel (P&E/S) aspect of Force 2013 engineer mobility capacity.

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[50] See note 43 for details on bridging training.

The erosion of basic heavy equipment operation, supervision skills, and road design will increase road construction times and jeopardize quality. Quantifying the loss of *flexibility* and *skill* is not easy; however, operational units continually struggle to find personnel qualified to construct high quality, improved roads and to build difficult bridges. This road construction shortfall came to light in 2006 when 23 Field Squadron experienced great difficulty constructing route SUMMIT through the PANJWAII district in Afghanistan because the Squadron only had one person qualified in horizontal construction and heavy equipment supervision.[51] The decrease in competent *skill* level is clear for both the sapper and their supervisors. Limiting the number of qualified personnel will reduce an engineer organization's ability to reorganize between close and general support roles within the Regimental structure. The current Chief of Defence staff, General Walter Natynczyk, described it best when he stated that the Canadian Army no longer has any "bench strength" left in its personnel pool.[52] Issues with the vehicles and equipment that support these mobility operations compound these personnel struggles.

The Second Shortfall - Key Engineer Vehicles and Bridging Resources

The same pressures and priority adjustments that have eroded technical *skill* levels in bridging and road construction also attack the vehicles and equipment used to provide the engineer mobility capacity. The Canadian Army mobility experience in Afghanistan has focused on route opening using CIED and EROC with little requirement for bridging and road construction. The same incomplete PRICIE process used for CFSME's individual training changes in the Personnel aspect of Force 2013 hampers the Force's Equipment area. The engineer heavy equipment pool is well beyond its usable lifespan, there are insufficient armoured engineer vehicles to meet operational tasks, and the quantity of bridging resources is woefully inadequate.

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[51] 23 Field Squadron, *Clearing the Way, Combat Engineers in Kandahar*, (London: Ardith Publishing, 2010), 47.

[52] Canada, Parliament of Canada-Senate, *Four Generals and an Admiral: The View from the Top*, (Ottawa: Government of Canada, 2008), 12.

The shortfalls in the amount of Force 2013 engineer vehicles and equipment severely restrict its mobility.

Three pieces of heavy equipment are integral to road construction - the dozer, front-end loader, and grader. These vehicles have an operating life, normally referred to as a life cycle or useful life, and maintenance requirements drastically increase the further an organization exceeds the normal life cycle. Civilian industry defines useful life as the point when half the vehicles in a fleet are scrap and at the age of twice the useful life, all of the equipment fleet is scrap.[53] Government agencies collect these statistics across the construction industry and the industry uses them to help plan for vehicle replacement and maintenance expectations. The California Air Resources Board's (ARB) expected useful lives of the dozer, loader, and grader are 16, 8, and 10 years respectively.

Using 1 Combat Engineer Regiment (1 CER) as an example, its fleet of dozers, loaders, and graders are 25, 27, and 26 years old respectively.[54] Delays in the replacement program for this fleet will see the vehicles achieve 28, 30, and 29 years of age before replacement. These figures indicate that the Canadian Army uses its vehicles two to four times longer than the recommended civilian heavy equipment industry guidelines. The combination of usage, well past life expectancy, and shortage of maintenance technicians has forced 1 CER to use the costly rental option for completion of training projects. Budgetary restrictions prohibit permanent rental options, which translate to reduced operator training hours due to a lack of vehicles on a permanent basis in garrison.

This lack of training vehicles further compounds the *skill* erosion mentioned previously in the Personnel section. Inexperienced operators damage vehicles more often and further

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[53] California Air Resources Board, *Off-Road Equipment Rule*, (Unknown: Air Resources Board, 2007), 8

[54] Major Lance Hoffe (Officer Commanding 18 Administration Squadron, 1 Combat Engineer Regiment) to Major Chris Swallow, personal email communications (17 January 2012).

increase maintenance requirements. Moreover, there is not a serviceable, permanent road construction fleet for domestic or deployed operations based in the Canadian Army's engineer regiments. Engineer units and CFSME must share limited numbers of serviceable vehicles and provide their training fleet for overseas deployment due to the lack of a Canadian Forces (CF) operational pool. While the Canadian Army recognizes the problem, procurement priorities have focused on CIED, EROC and Armoured Engineer Vehicles for force employment in Afghanistan. Replacement delays of the current dozer, loader, and grader fleet continue and the project is still three years away from vehicle replacement delivery.[55] Force 2013 does not possess an integral road construction vehicle capability and the armoured engineer vehicle fleet experiences similar strains due to age.[56]

The Army's current fleet of armoured engineer vehicles consists of the armoured vehicle laid bridge (AVLB) and the armoured engineer vehicle (AEV). The AVLB provides a rapid combat-bridging capability under enemy contact and the AEV delivers front-line dozing and excavating. Operations in Afghanistan employed the AEV only, and used the vehicle for route opening/breaching (dozing) and armoured heavy equipment tasks (excavating and dozing) in high-risk areas. Lack of recent usage in Afghanistan, rising sustainment costs, and budgetary constraints combined in the Army's decision to permanently remove the AVLB from service. More importantly, the removal of the AVLB chassis also includes the loss of approximately twenty AVLB bridges (22 metres in length) from the Army inventory. This decision effectively eliminates the engineer capability to bridge gaps under fire and places an increased burden on the

[55] Major Lance Hoffe (Officer Commanding 18 Administration Squadron, 1 Combat Engineer Regiment) to Major Chris Swallow, personal email communications (17 January 2012).

[56] Master Warrant Officer M. Mazerolle (Squadron Sergeant Major 13 Armoured Squadron, 1 Combat Engineer Regiment) to Major C. Swallow, personal email communications (16 January 2012). Current vehicles are 22 years old and will see them at 27 years old before replacement project delivers new vehicles, not before 2017.

minimal supplies of military bridging by discarding almost one third of the Army's bridging spans.

In contrast to abandoning the AVLB fleet, the Army has used the AEV fleet extensively. So extensively, that the serviceability of the meager fleet is monitored at the national level. Delays in procurement of replacement vehicles and extremely high usage on operations almost destroyed the small, nine-vehicle fleet. The Canadian Army used one-half of the fleet in operations, several of the vehicles have been destroyed, and force generation continuously uses the remainder. The demand on the small fleet is extraordinary and no operational replacement pool exists for the deployed fleet. The force generation fleet (three vehicles) is used simultaneously for initial operator qualification, small-unit workup training (troop level training), and task force validation exercises. To be clear, this represents three separate training entities, provided by a single force-generating unit (1 CER), all vying for the same three vehicles at the same time.

Analysis of training timetables in 2008 proved that the fleet could not sustain force generation and led to the short-term solution of procuring three used German Army AEVs.[57] Delays in replacement increase wear on an already over-taxed fleet. Despite the high profile use of the AEV on operations, the replacement vehicle project will not deliver a new vehicle before 2017.[58] Training time for operators and combined-arms exercises barely meet acceptable minimum requirements. AEV competency satisfies current force employment requirements but does not achieve the level required to engage in combat against a skilled conventional force opponent. Combined with the loss of the AVLB capability, the Canadian Army reductions in

[57] Major C. Swallow, *AEV Training and Vehicle Fleet Assessment,* (Edmonton: 1 Combat Engineer Regiment, 2008).

[58] Master Warrant Officer M. Mazerolle (Squadron Sergeant Major 13 Armoured Squadron, 1 Combat Engineer Regiment) to Major C. Swallow, personal email communications (16 January 2012).

armoured engineer capability affects the ability to provide mobility in direct contact with the enemy. Wet gap crossings must now rely upon other military bridging resources.

With the removal of the AVLB bridge from the Army inventory, CF military bridging now consists of Medium Floating Raft/Bridge (MFR/B), Medium Girder Bridge (MGB), ACROW, and non-standard bridging (NSB).[59] As part of career courses, CFSME teaches MFB and MGB with severely reduced training time allocations. ACROW, advanced MGB, and NSB bridging is a specialty course as previously discussed. Bailey and Mabey-Johnston are not taught at all. The combination of reduced training on the bridging at CFSME and a lack of physical bridging resources in the respective Land Force Areas (LFAs) severely reduces the Force 2013 engineer-mobility capability.[60] With the loss of the AVLB fleet, the MFB and MGB provide the only bridging capable of construction in contact with the enemy; but vulnerable dismounted engineers must assemble them.

Each LFA has either a 31 or 46m MGB set, three ACROW bridges (1 x 48m, and 2 x 18m), and one MFB with four to six interior bays (approximately 40m total).[61] There is no national operational stock and no bridging currently deployed overseas. The resources at each LFA are shared between the one Regular Force engineer regiment and up to three Reserve Force engineer regiments, separated by as much as 2500 km (LFWA). These resources translate to the equivalent of one floating and three to four gap span bridges per LFA, or a single, limited operational response. Operation LAMA in September 2010 demonstrated the value of these bridging resources and their limitations due to the inadequacy of the current resource levels. Hurricane Igor decimated the province of Newfoundland and the military response did not have

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[59] http://acrowusa.com/. ACROW is a commercial bridging manufacturer name that delivers a product similar to Bailey bridge.

[60] The Canadian Army is divided into four, geographically based, Land Force Areas. Atlantic, Quebec, Central, Western, and Northern Area (LFAA, LFQA, LFCA, LFWA, respectively).

[61] Major Jason Gale (Canadian Army HQ Engineer Support Coordination Centre) to Major Swallow, personal email communications (8 September 2011).

sufficient bridging to satisfy emergency needs. Moreover, having emplaced its resources in Newfoundland, LFAA is currently without bridging resources to conduct training or additional operational deployments. Their entire resource pool was lost for two years. One year committed in position and, upon removal from Newfoundland locations, a further year of refurbishment at the manufacturer.

Combined with the inadequate resource levels is the force generation structure's severely restricted willingness and capacity to employ them due to individual training reductions at CFSME. The specialty course mitigation alternative for advanced MGB, ACROW and NSB does not work. There is a misconception that the advanced bridging course is creating bridging subject matter experts (SME). The reality is that the course is teaching half of the bridges previously included in engineer core training. The end product is a course graduate with 75 percent of the previous core training, not a bridging SME.[62] For example, operational tempo and limited course throughput at CFSME left 4 Engineer Support Regiment with only two qualified personnel to emplace ACROW during Operation LAMA in 2010.[63] That restricted the unit to only two bridge recce and/or constructions at one time. This illustration demonstrates that the lack of qualified personnel and inadequate resource levels, coupled with the loss of the AVLB, leaves no options for overseas deployment of Canadian bridging capability without profound effects on domestic training and emergency response.

The loss of bridging expertise will severely restrict the Force 2013 engineer's provision of mobility and is a startling example of a shortfall in a capability area completely reliant on qualified personnel using adequate vehicles/resources. Engineer dependence on their *equipment and stores* is well known. The use of heavy equipment well past its usable life, a severe shortage

[62] Major Paul Kernaghan (Officer Commanding Field Engineer Training Squadron, Canadian Forces School of Military Engineering) to Major Chris Swallow, personal email communications (10 January 2012).

[63] Major Jason Gale (Canadian Army HQ Engineer Support Coordination Centre) to Major Swallow, personal email communications (8 September 2011).

of armoured engineer vehicles and inadequate bridging resources drastically restricts engineer mobility operations. If the funds exist, then rental options can mitigate heavy equipment shortages in some locations. For the most part; however, the difficulties with these resource items cannot be rectified by the local commander and require national attention. The perseverance to the "do more with less" attitude as applied to aging equipment places a significant burden on unit maintenance resources. The PE&S framework shows the compounding effect of the Personnel aspect on Equipment because of the incomplete CBP process. This effect continues to grow and directly attributes to increased problems in the area of Support (P&E/S).

The Third Shortfall - Integral Combat Service Support Shortages

The Canadian Joint Task List (CJTL) assesses the Canadian Army's tactical logistics support capability as RED and not meeting current needs. The CJTL recognizes personnel issues, equipment/vehicle deficiencies, bulk fuel handling shortfalls, and insufficient repair parts scaling plaguing the Army's sustainment community.[64] The fiscal year 2011/2012 Canadian Army operating plan provided the best example of Combat Service Support (CSS) shortfalls. The operating plan explained the proposed attempts to resolve the 731,000-hour gap between available labour and annual maintenance requirements.[65] This was a result of a disconnected CBP process, which manifests itself in the Support aspect of Engineer regiments. Both Engineers and CSS elements conducted PRICIE analysis; however, the CBP process became disconnected because of communications breakdowns and inadequate oversight at the national level. There is now a support gap in Engineer regiments.

Army growth had a finite limit with the legislated addition of 5000 personnel in 2005. Operational requirements led to a drastic increase in overall Engineer end strength. For example,

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[64] Technical Panel 3, *Guide to Capability Based Planning*, (Washington: The Technical Cooperation Program, 2003).

[65] C-DND, *Land Forces Command Operating Plan FY 2011/12*, (Ottawa: Canadian Army HQ, 2011), 2-14.

1 Combat Engineer Regiment almost doubled in size from a strength of slightly more than 300 personnel in 1995 to its current authorized manning of 545. Engineers had priority in the Army growth program. The corresponding CSS increases, to support the growth in engineer regiments, exceeded the overall Army growth limit. The Canadian Army assumed risk and increased Engineer strength without the necessary CSS structure to support it. Simultaneously, the Army had difficulty sustaining viable CSS manning in several trades and the Army equipment rationalization plan (ERP) exacerbated the structural gap.[66] As a result, the existing CSS structure in the four Engineer regiments cannot meet the mobility needs of Force 2013. Engineer regiments lack sufficient maintenance, supply/messing, and POL resources to satisfy operational requirements.

The 1 CER example illustrates the subsequent CSS gap created by uncoordinated engineer growth. Between 1995 and Force 2013, 1 CER will increase its engineer strength two-fold and grow structurally from two field squadrons to four.[67] In broad terms, the unit doubled in both personnel and vehicles. The changes in CSS were negligible.[68] A direct correlation would then estimate the CSS gap at approximately 50 percent in personnel and vehicles. This gap assumes that all CSS positions are manned and vehicles are present. Personnel problems and ERP prevent that from occurring and result in a CSS gap that is likely higher. A substantial CSS gap, connected with an aging/over-used vehicle fleet, severely limits engineer mobility capabilities. More engineer personnel working in disparate locations, high equipment failure rates and aging

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[66] The Canadian Army does not purchase vehicles for a deployment or replacement stock of vehicles. The Army ERP was initiated in 2005 and was designed to create a training pool of vehicles for the new National Training Centre (NTC). Subsequently, vehicles deployed to Afghanistan from the NTC and left a severely degraded fleet for force generation. End-state in most Army units was one company or squadron of combat vehicles and about less than 50 percent of regimental CSS vehicles. Due to reliance on vehicles/equipment, most engineer regiments kept approximately 75 percent of their combat vehicles but only half of its CSS. Of note, none of the vehicles lost in combat in Afghanistan have been replaced.

[67] C-DND, *Director Engineers Brief to Force 2013*, (Kingston: Director Engineers, 2011).

[68] Major Lance Hoffe (Officer Commanding 18 Administration Squadron, 1 Combat Engineer Regiment) to Major Chris Swallow, personal email communications (17 January 2012).

vehicles require more maintenance hours, additional spare parts and more fuel. This translates to the need for a strong maintenance team, large POL transport requirements, and robust supply/messing capability.

The best example is the shortfall in maintenance capability within the Canadian Army. As previously mentioned, there is a 731,000-hour annual shortfall. This translates to a gap of approximately 622 mechanics just to deal with last year's backlog in the Army or about 20 mechanics for each combat unit within the Canadian Army.[69] This realistically means the average unit needs to double their effective maintenance strength to resolve the annual shortfalls and surge 622 mechanics, for one year, across the Army to deal with the existing 731,000-hour backlog. The current contracted solution of 160 mechanics for the entire Canadian Army is not going to accomplish the desired goal.[70] Units normally have less than 25 percent of their vehicles serviceable at any given time and morale in the maintenance organizations is suffering.[71]

Compounding the CSS personnel shortfalls was the institutionalizing of the "Whole Fleet Management Program." An overall shortage of key vehicles across the Canadian Army demanded a program to do more with too little.[72] Under this program, the Canadian Army shared its vehicle fleet and units would only receive vehicles at the exact time they were required for a specified level of force generation training. The actualization of this program in 1 CER left a substantial CSS gap. The Regiment has only one refueler in the unit and supply/messing/maintenance support for only one squadron at a time. The maintenance backlog is beyond unit capabilities and

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[69] Average of 25 hours production time/week (given physical fitness and mandatory annual military qualifications only) and 47 weeks production per year after leave= 1175 hours per mechanic/year. This results in a shortfall of 622 mechanics to resolve a single annual shortfall. Approximately 35 combat units requiring maintenance in the Army translates to a shortfall of 20 mechanics/unit.

[70] Mr Joe Ur (Contract Supervisor – LFWA B-vehicle maintenance) to Major Chris Swallow, personal email communications (18 December 2011).

[71] Major Lance Hoffe (Officer Commanding 18 Administration Squadron, 1 Combat Engineer Regiment) to Major Chris Swallow, personal email communications (17 January 2012).

[72] Canada, Parliament of Canada-Senate, *Wounded: Canada's Military and the Legacy of Neglect*, 34.

they are only able to repair mission critical vehicles; just in time for training. This *limits* regimental training programs to relatively static locations with an ability to support only one of its four sub-units moving at any given time. There is very little capacity to send a sub-unit on deployment with integral unit CSS elements since they simply do not exist within the regiment. Thus, it is evident that assumed risk, to achieve combat growth across the Army, left a gap in unit CSS elements that even general support CSS units cannot fulfill. The maintenance shortfalls are a glaring example of the problem. Mobility operations require large amounts of personnel, vehicles, and resources. Force 2013 does not address this CSS gap in Engineer regiments and thus will assume the existing force generation structure Support *limitations* to its mobility capability.

Summary of Realistic Force 2013 Engineer Mobility Capabilities

At the 1994 Senior Engineer Leaders Training Conference, Major-General Joe Ballard described one of the key elements of the modern military engineer "if engineers are to retain their valued position on the combined arms team, versatility must become their trademark."[73] The combined effects of the changes in the individual training program at CFSME, equipment procurement/replacement program delays, and lack of integral combat service support are causing the Canadian Military Engineers to lose versatility in their mobility capabilities. The capability based planning (CBP) process steps of conceive, design, build, and manage were rushed to meet an operational demand for Afghanistan. The timeline did not permit the completion of the PRICIE analysis to determine the effects of changes in reduced bridging and horizontal construction training. The Canadian Army has cannibalized its institutional Army to meet the demands of operational deployments.[74]

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[73] Alan Schlie, "Restructured Heavy Division Engineer Support," *Engineer* 24, no. 3 (1994).

[74] Canada, Parliament of Canada-Senate, *Wounded: Canada's Military and the Legacy of Neglect*, 35.

The assessment of horizontal construction and bridging capabilities reveals a reality in which the technical mobility *skills* of engineer personnel has decreased, key *vehicles and resources* are beyond repair or not present in adequate quantity, and there is insufficient integral combat service support. This degradation in the overall specialized personnel *skill* sets severely reduces *flexibility*. Compounding this is a systemic failure to replace aging or insufficient quantities of vehicles and resources. Simultaneously, integral combat service support is decreasing while its supported element has grown; further *limiting* engineer mobility operations.

The uncoordinated CFSME changes to core training have severely damaged road construction and bridging knowledge, skills, abilities, and competencies. Also, key equipment and integral combat service support is not present in sufficient quantities. Heavy equipment and AEVs are well beyond their usable life spans and have not been replaced in a timely manner. The quantity of serviceable bridging is inadequate to meet the combined training needs of the Regular and Reserve force engineers and the Canadian Army does not stock any deployable bridging. The combined effects of these considerations are a Force 2013 engineer structure, which will inherit the shortfalls of the existing force generation structure.

To reverse this reality, the Canadian Military Engineers should take the opportunity provided with the cessation of combat operations in Afghanistan to re-invest in its core capabilities. This re-investment begins with reversing the reductions in core engineer mobility training in order to re-establish technical engineer expertise in horizontal construction and bridging. The focus on these technical areas continues with the rapid replacement of aging engineer vehicles and the establishment of operational pools, both of heavy equipment and bridging resources. Finally, the disparity gap between engineer growth and integral support must be eliminated with a clear increase in combat service support elements in the combat engineer regiments. The priority must be the long-term health of engineer technical expertise to ensure the mobility capability of Force 2013 is prepared to meet, not only the demands of today but also the

challenges of tomorrow. With an understanding of the mobility capacities of the current and Force 2013 force generation structure, the question remains, what are they tasked to accomplish?

Chapter 2: Strategic Tasks – What is Force 2013 Required to Accomplish?

Introduction

Martin Shadwick, in the *Canadian Forces Journal*, explains the decade of darkness as a commitment-capability gap.[75] According to Professor Hew Strachan, these gaps occur because of a breakdown in the iterative, dynamic relationship of strategy and policy.[76] Canadian Prime Minister, Steven Harper, and his government have taken steps to improve the strategy-policy relationship and reduce the commitment-capability gap through the release of a national defence strategy as well as increasing funding to the Canadian military. These documents form the basis of the current military strategic structure and guide the annual direction given to the Canadian Forces (CF). This Chapter will determine the general force generation structure Personnel & Equipment/Support (P&E/S) requirements of the national security policy, national military strategy, domestic contingency operation plans, as well as the current fiscal year Canadian Army operating plan. The aim is to evaluate the strategic demands of the Canadian Army and measure them against the quantification of the realistic ground mobility capacities (Chapter 1) of the Force 2013 structure to yield an operational assessment of the commitment-capability gap.

Canada's National Security Policy

The Government of Canada published its only national security policy in 2004. "Securing an Open Society: Canada's National Security Policy" is an eight chapter document which describes the Government's understanding of the security problem and details its integrated

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[75] Martin Shadwick, "Comparison Shopping," *Canadian Forces Journal* 10, no. 4 (2011): 14.

[76] UK Parliamentary Publications, *Who Does UK National Strategy – Public Administration Committee*, (London: Government of the United Kingdom, 2010), 2.

approach to solving it.[77] Although written by a previous Liberal government and not recognized by the current Harper government, this policy has not been superseded and is useful to demonstrate the nesting of the National Defence strategy. In the National Security Policy, Canada believes that national prosperity is linked to openness, but at the same time, they recognize the vulnerable position in which this policy places the nation. The policy has an inward-outward priority of focus and centres on three national security interests: protecting Canada and Canadians at home and abroad; ensuring Canada is not a base for threats to its allies; and contributing to international security. Understanding the nation's security interests, the Government of Canada (GoC) recognizes two primary threat areas: security and public safety.[78]

The policy describes an inward-outward focus for the Canadian Forces (CF) based on the assignment of capability priorities. Starting internally and moving out, the CF will play a vital role in responding to domestic emergencies, defending Canada, helping secure North America, and addressing threats to our national security as far away from Canada's national borders as possible.[79] The inward-outward focus in "Securing an Open Society" requires a flexible, responsive, and combat-capable Canadian Army supported by versatile engineers providing a robust mobility capability. The discussion will develop the inward (emergency preparedness) and outward (international operations) mobility capability requirements of the Army and more specifically its engineers.

The complexity of domestic responses to natural disasters demands an integrated national support system to make best use of meager federal resources while minimizing human suffering

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[77] Canada, Privy Council Office, *Securing an Open Society: Canada's National Security Policy*, (Ottawa: Government of Canada, 2004), vii & 1. National Security Policy Integrated in the context of the national security policy refers to a whole of government approach where all federal departments are working cooperatively to share intelligence and coordinate efforts both amongst each other as well as with other international partners.

[78] Ibid., 1.

[79] Ibid., 49.

and economic losses.[80] The GoC expects the CF to figure prominently in the consequence management of national emergencies. It also created a Public Safety Department to address organizational aspects of federal emergency management. At the same time, the GoC understands the system wide inadequacy and insufficiency of resources across the country to sustain operationally intense emergencies. To modernize emergency management, the GoC must fill municipal/provincial capability gaps at the federal level and work collectively with all levels of governance as well as first responders to modernize the management system.[81] In accordance with the inward-outward focus assigned to the CF in the National Security Policy, three areas describe the CF's likely involvement in domestic emergency preparedness: the mobility of federal assets; knowledgeable and experienced personnel supporting the regional, integrated operations centres; and the general capacity/capability to play a prominent role in any emergency operations.

Because of the vast distances involved in Canada, the national road network is vital. Canada relies on its transportation network to move people and goods between communities within Canada as well as to international trade partners. One of the key elements of the CF's role is the mobility of federal assets to repair this network in emergencies. The Canadian Army's geographic placement across the country often represents the most rapid response of federal assistance in addition to the Army's inherent ability to provide mobility to other government departments. This federal capability needs to fill a gap at the municipal/provincial level in terms of a rapid bridging and road construction capability. The remoteness of most Canadian communities highlight the local inadequacy to sustain emergency road repairs in isolated areas and also the complete inability to construct temporary bridging quickly in disaster scenarios.

[80] Ibid., 21.

[81] Ibid., 22.

The 2010 Operation LAMA response to Hurricane Igor, in Newfoundland, is an example of this problem. While the moral and legal responsibility to address this mobility gap may reside with the Provincial Department of Transport, the reality of federal agencies is that the CF is the only one possessing any capacity to provide a solution and, as described in Chapter 1, they are not adequately resourced for this task. Additionally, the GoC expects the Canadian Army to provide the operational knowledge and experience to support municipal/provincial agencies through leadership by example within the established integrated emergency management organizational structure.[82] The Canadian Army's obligation to lead by example continues in overseas operations.

In its outward focus, the GoC supports contributing national resources to maintain international security. To achieve this goal, Canada must leverage its experience in building peace, order and good government to help developing, failed and failing states. This includes development assistance to strengthen/rebuild public institutions through an integrated approach of defence, diplomacy, and development.[83] The Army plays a critical role in increasing the overall capacity of the integrated approach by improving the GoC military-civilian relationship during deployments and supporting the soldier-diplomat philosophy.[84] These requirements necessitate an Army that is mobile, flexible, responsive, and combat-capable for a wide range of operations as well as being interoperable with its allies. Members of the Canadian Army must be knowledgeable and experienced in order to adapt broad stabilization solutions and assist in the reconstruction of democratic institutions in foreign locations.[85] Mobility is a key factor in all

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[82] Ibid., 24.

[83] Ibid., 6 & 47.

[84] Tony Corn, "From War Managers to Soldier Diplomats: The Coming Revolution in Civil Military Relations," *Small Wars Journal*, (2009), 1. Soldier Diplomat is a warrior dually capable of conducting diplomacy/development as well as combat when that fails.

[85] Canada, Privy Council Office, *Securing an Open Society: Canada's National Security Policy*, (Ottawa: Government of Canada, 2004), 49.

reconstruction efforts and the Canadian Military Engineers (CME) are the sole provider of this capability in the deployed GoC package.

"Securing an Open Society" obligates the Government of Canada to prepare the CF adequately for all of its security tasks. The CF's responsibility is to balance its resources, in accordance with priorities, at home and abroad. The policy demonstrates the Government's knowledge that it must be selective and strategic when considering deployment of the CF. Thus, the Canadian Army must ensure that it does not limit employment options due to the absence of a critical capability.[86] To fulfill the policy goals, the Army must have an operational mobility capability both at home and abroad.

The integrated GoC approach relies upon the Army to provide its mobility. In order to provide a reliable mobility capability, the Army must possess sufficient resources in the key mobility aspects of road construction and bridging as well as the professional ability to execute those two technical operations. This requires a knowledgeable and experienced personnel base, both in of support operations as well as to provide best military advice in the integrated operations centres. Additionally, it requires sufficient heavy equipment and bridging resources. The GoC's desire to provide federal personnel to integrate into provincial emergency operations centres and to increase CF Reserve Force capacity to deal with local emergencies further complicates the issue.[87] Operation LAMA is an excellent example of how these desires increase the number of personnel and bridging resources required for the task; however, the current resource levels are inadequate for the task.

Partnership with allies in operations abroad can allow some assumption of risk in the provision of mobility to the CF overseas; however, a deployed force without integral mobility will see its credibility and effectiveness greatly reduced. The federal commitment to cover

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[86] Ibid., 50.

[87] Ibid., 24

municipal/provincial gaps in emergency capabilities does not permit the assumption of the same risk in mobility capability in the top priority mission for the CF domestically. The National Security Policy demands a versatile engineer mobility capability at home to cover the local gaps in rapid bridge construction and remote road construction. The National Military Strategy needs to address the key elements of these means shortages.

Canada's National Defence Strategy

The means shortage of the CME becomes more apparent in Canada's National Defence Strategy. The title of the strategy, "Canada First", is significant in that it re-emphasizes the inward-outward focus of priorities iterated in the National Security Policy.[88] In the strategy, the Prime Minister and the Minister of National Defence (MND) task the Canadian Forces (CF) to demonstrate excellence at home, be a strong reliable partner in the defence of North America, and to project leadership abroad by making meaningful contributions to international security operations. The MND states that the strategy will serve as a level of ambition for the government with clearly defined roles and missions for the CF. This enables the CF to meet the country's defense needs, enhance the safety and security of all Canadians, and support the government's foreign policy/national security objectives.

The military will deliver on this level of ambition by maintaining its ability to conduct six core missions within Canada, within North America, and globally, or at times any mix of these simultaneously. The six core missions for the CF are: the conduct of daily continental operations in the arctic and for NORAD; the support of major international events in Canada such as the Olympics; response to major terrorist attacks within Canada; the support of civilian authorities during crisis in Canada such as a natural disasters; leadership of and/or conduct of major international operations for extended periods; and the deployment of forces in response to crisis

[88] Canada, Ministry of National Defence, *Canada First Defence Strategy*, (Ottawa: Government of Canada, 2008).

elsewhere in the world for shorter periods.[89] In the strategy, the GoC acknowledges a requirement to increase the size of the CF and replace its neglected core capabilities while detailing four pillars of military capability building: personnel; equipment; readiness (training); and infrastructure.[90] The mobility of the CF provides one of the core capabilities for the strategies of excellence at home and leadership in strong partnerships abroad.

Providing excellence at home has challenges for the CF, which includes citizen expectations, balance in the four pillars of capability building, CF institutional responsibilities, and sovereignty protection. Canadians rightly expect their military to be there in times of domestic crisis and the CF must be able to respond to contingencies anywhere in the country. This follows in the guidance of the National Security Policy, which foresees the CF playing a prominent role in the emergency management process. The review of the security policy discussed the mobility difficulties experienced by the CF in this respect. Further, a healthy Canadian Forces (CF) will maintain a balance in the four pillars of capacity building (personnel, equipment, readiness/training, and infrastructure). Focus on one capacity at the expense of another within a pillar or on one pillar over another may meet short-term operational needs but does not ensure the stability of the overall structure in the long-term.

Some core mobility capabilities have suffered from imbalance in the past decade. Additionally, to maintain the strength of the organization in the long-term, the Canadian Army must be conscious of its institutional obligations. In order to provide adequate space for training and basing across the country, the Department of National Defence is the federal government's largest landowner. With this obligation comes a critical institutional mobility requirement to

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[89] Ibid., 3.

[90] Ibid., 18. Readiness refers to the CF's flexibility and preparedness to deploy in response to government direction. It encompasses the resources to maintain equipment, conduct training and prepare units for operations. With the other pillars separated, this largely speaks to training of the force.

maintain almost 5500kms of road networks on CF installations.[91] The vastness of the country and difficult operating environments are also evident in the CF's sovereignty protection challenges, particularly in the arctic. The sovereignty of the resource rich, Canadian arctic is challenged continuously and mounts an enormous mobility challenge to the Canadian Army.[92] These four areas affect the Army's core mobility capability and challenge its provision of excellence at home, which further translates to difficulties in the same capability abroad.

Leadership in strong partnerships abroad demands a modern, well-equipped CF with robust core capabilities to address global uncertainty. The CF must be flexible, credible and able to act simultaneously in multiple locations. This is the strategy's expansion of the policy belief that ties prosperity to openness and stability, which requires a defense strategy to tackle threats at their source. To be credible, the CF cannot lead with words alone and must be able to deploy realistic capabilities. Lessons learned from Afghanistan demonstrated a need for a mix of equipment and trained personnel that are capable of working with allies or alone when contributing to reconstruction efforts in harsh and unforgiving environments.[93] A key enabler of the desired flexibility, credibility and simultaneity is the Canadian Army's core mobility capacity. The physical ability to go where you are needed, when you want to be there, without waiting for the assistance of another nation's military, or civilian contractors, to provide the capability is crucial to the CF's responsibility in the integrated Government of Canada approach.

The defence strategy develops objectives based on an assessment of the government's expectations. Insufficient resourcing in road construction and bridging coupled with an increased operational tempo as well as aging equipment erode the Army's preparedness to undertake short notice and/or simultaneous operations. An improved long-term procurement strategy for bridging

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[91] Ibid., 19.

[92] Ibid., 8.

[93] Ibid.

and heavy equipment will also satisfy the defence strategy's desire to benefit Canadian commercial industry and grow capacity in relevant knowledge and technology industries.[94]

The 20-year planning/generating process develops the capabilities needed to achieve the desired outcomes. This breaks down when the Capability Based Planning (CBP) process is incomplete, as in the case of the CIED generation for Afghanistan. Incomplete CBP caused an imbalance in the four capacity building pillars, thus negatively affecting the strategy through the loss of flexibility. The strategy expresses people as its most important resource; however, reality sees them short changed in mobility training and education.[95] All of these issues challenge the strategy's delivery of a balanced, multi-role, combat capable force that will give the Government of Canada the necessary flexibility to respond to a full range of global demands. The CF's mobility capacity lies at the core of the excellence at home and leadership in strong partnerships abroad strategy to fulfill the National Defence Strategy. In order to understand how the strategy translates into tactical direction, it is necessary to review domestic contingency plans and the annual Canadian Army operational order.

Canadian Forces Domestic Contingency Operation Plans

The Canada First strategy embodies the mindset of Canadian Forces (CF) operations within national borders. Federal law and public expectations contribute to a different domestic employment concept for the CF in relation to its U.S. counterparts. Headquarters Canada Command is responsible for domestic operations. As a basis for response to assistance requests from provincial governments, HQ Canada Command uses a set of standing contingency plans for floods, forest fires, ice storms, catastrophic earthquakes (British Columbia), hurricanes, influenza epidemics, and maritime threats/incidents. The requests for assistance can occur anywhere in

[94] Ibid., 13.

[95] Ibid., 14 & 16.

Canada and are often thousands of kilometers from the nearest Canadian Forces installation. All contingency plans expect assessment expertise and provision of personnel and equipment within 12-24 hours from the Canadian Army.

In general, the contingency plans prioritize responsibilities as saving lives, protecting property, and transitioning quickly to provincial/municipal recovery efforts.[96] As a measure to demonstrate the CF's commitment to the Canada First strategy, the primary strategic objective is to provide a timely and relevant response, to an overwhelmed province or agency anywhere in Canada, within 12-24 hours.[97] In almost all cases, less maritime threats, the Canadian Army and its standing Immediate Response Units (IRU) are the first elements of the CF to be committed to domestic contingency operations.[98] The expectation in a natural disaster is that the highways, airports, railways, waterways, etc are inoperable or damaged, so mobility is a key for ground forces.

The Canadian Army requires a robust mobility capacity to be able to travel to the affected location, assess the local requirements, and then restore ground connectivity. Military engineer expertise brings a unique ability for rapid bridge construction and road building that does not exist in any other civilian agency. To meet expectations of a quick and relevant response in a contingency operation, Canadian Army engineer units must have trained personnel as well as serviceable vehicles and equipment prepared to deploy.[99] The current maintenance backlogs, lack of trained engineers for bridging/road construction, in addition to shortages of bridging resources and aging heavy equipment call into question the Canadian Army's ability to bring a unique

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[96] Canada, Department of National Defence, *CONOP LOTUS – CANADACOM 10254/06 Response to Flood Mitigation Ops,* (Ottawa: Headquarters CANADACOM, 2009), 2.

[97] Canada, Department of National Defence, *CONOP LYNX – CANADACOM 001/2006 Plan to Assist Fighting Forest Fires,* (Ottawa: Headquarters CANADACOM, 2006), 3.

[98] Each of the three Canadian Army brigades provide an IRU capability, based on a combat arms battalion with 8 hours notice to move, to respond to Northern, Western, Central, Quebec, and Atlantic area requests for assistance.

[99] Canada, Department of National Defence, *CONOP LADON – CANADACOM Response to Catastrophic Earthquake in B.C.,* (Ottawa: Headquarters CANADACOM, 2011), 10.

capability and relevance to a domestic operation. Land Force Command's Operating Plan for fiscal year 2011/12 further expands on the Canadian Army's mobility expectations of its engineers.

Canadian Army Fiscal Year 2011/2012 Operating Plan

The annual Army Operating Plan details the Commander Canadian Army's direction to his subordinates in a given fiscal year. The plan includes the Commander's intent and his philosophy, which guides operations for the upcoming year. It also provides information on the allocation of force structure, tasks, budgets, equipment and vehicles, resources, ammunition, infrastructure, and Army projects. A separate, but complimentary, document is the Army critical topics list (Army CTL). The Army CTL elaborates on staff efforts and establishes priorities for the upcoming two years. The CTL is in the form of a prioritized matrix listing each topic, then describes the general aspects of the topic, next explains each of the lines of interests within that topic, and finally specifies which Army planning agency is the principle stakeholder for the issue. This document focuses Army staff planning efforts and it provides a central point of contact for an issue within the Army staff structure.

Upon review of the Army CTL for 2011-13, three areas are important for the discussion of the Army's mobility capacity and an understanding of its planning priority. The first important area was the CTL's second critical topic, training as you fight, which includes a line of interest reviewing individual and collective training deficiencies.[100] The Canadian Army Training Authority (ATA) is responsible for this line of interest and would be the point of contact for identified bridging and horizontal construction training deficiencies in engineer mobility training. Secondly, in the third critical topic, equipping as you fight, the primary line of interest is the assessment of current capability gaps and the suitability of equipment for operations today and in

[100] Canada, Department of National Defence, *Army Critical Topics List (CTL) 2011-2013*, (Ottawa: HQ Canadian Army, 2010), 2.

the future.[101] This tasks the Chief of Staff Land Strategy as the stakeholder for the discussion on the availability of training and deployment stocks of bridging resources. Finally, within the mission specific capabilities topic there are mentioned lines of interest for both the Armoured Engineer Vehicle and heavy equipment procurement and sustainment projects.[102] There are eleven topics on the Army CTL list and the inclusion of mobility capacity issues in three of the top four topics stresses the importance of this core engineer skill to the Army Commander. The fiscal year 2011/12 operating plan furthers this point.

The Canadian Army Commander details four themes in his fiscal year 2011/12 operating plan. First theme is to protect Canada at home and abroad. Second, his main effort is reorientation – that is to recover, reconstitute, and reorient the Army within the broader Canadian Forces reconstitution process. Third is operational readiness, and fourth resources – which is the adjustment of the Army's training, equipment, people, and infrastructure to achieve a sustainable resource balance.[103] The Commander's priorities include force generation for operations, emphasis on building and sustaining leadership capacity through individual and collective training, and executing capital equipment programs.[104]

The operating plan also acknowledges that the whole fleet management project stripped vehicles from the Army's organizational structure and placed them only into units requiring them for force generation training. It also highlights the annual 731,000-hour maintenance labour gap and an estimated five-year shortage in qualified personnel across the Army.[105] The identified gaps and shortfalls are a result of the imbalance caused by the Army's force generation requirements

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[101] Ibid., 4.

[102] Ibid.

[103] Canada, Department of National Defence, *Land Forces Command Operating Plan FY 2011/12*, (Ottawa: Canadian Army HQ, 2011), 1-4.

[104] Ibid., 1-3.

[105] Ibid., 2-12, 2-14, 3-1.

for the war in Afghanistan. The Commander's main effort of reorientation is the Army's methodology for restoring a sustainable balance in the force.

The reorientation is expected to restore foundational training. This is the training conducted by the Canadian Army to restore core competencies for use or adaptation across the full spectrum of conflict.[106] This period of adjustment is a critical time for the engineer mobility capacity. Progress must continue on the procurement process for AEV and heavy equipment replacements as well as improving the sustainment capability of the fielded fleets.[107] Additionally, bridging and horizontal construction training needs re-adjustment to restore balance in the full-spectrum engineer mobility capacity. The 2011/12 operating plan confirms that shortcuts were necessary to meet the force generation requirements of the past decade, but demands that the Army adjust in order to restore organizational balance. The guiding philosophy of this operating plan furnishes the opportunity to review engineer mobility issues and establish the framework, which will restore the required full spectrum capability.

Summary of Strategic Engineer Mobility Requirements

Canada's national security policy, defence strategy, operational contingency plans, and the 2011/12 Army operating plan all demand the same characteristics of its military forces. That is a flexible, responsive, credible, operationally ready, combat effective Canadian Army. The Army must provide a quick and relevant response to mobility demands for federal assets in remote locations across Canada. To accomplish this, the Canadian Military Engineers (CME) must generate knowledgeable and experienced personnel to execute mobility operations and provide best military advice to civilian, Government of Canada partners, during both domestic emergencies and deployed operations. The Canadian Army cannot accept risk in its domestic

[106] Ibid., 3-B-3-1.

[107] Ibid., 32-33.

mission to fill in the provincial and municipal capability gaps in the areas of rapid bridge construction and emergency road construction.

These requirements relate directly to the previously discussed characteristics of military engineering support to operations. The CME must possess *flexibility, skill, mobility, equipmen*t and *stores*, as well as reduce its *limitations* in order to meet Canada's strategic requirements. Engineers should use the Army Commander's focus in his operating plan to re-invigorate Army staff efforts to replace aging/inadequate vehicles and equipment. They should take the opportunity to re-orient CME core mobility training in the areas of horizontal construction and bridging. To be successful in the long-term, the CME must restore a sustainable balance between its engineer strength and the combat service support manning in combat engineer regiments to reduce their support *limitations*. Addressing these current requirements will allow the CME to complete today's strategic requirements with a view to meeting the demands of future operating environments.

Chapter 3: The Future – What Will Force 2013 Likely Need to Accomplish?

Introduction

Colin Gray aptly describes the challenges in predicting the future when he wrote, "the dominant reality for the defense planner is uncertainty."[108] Strategists attempt to decipher the complex and chaotic world of global affairs in order to define the future operating environment. Military planners then struggle with the strategist's prediction in order to determine what capabilities they will need to generate for the future. Gone is the era of reasonable predictability and we are now entering an era of surprise and uncertainty.[109] The analysis of military

[108] Colin S. Gray, "Coping with Uncertainty: Dilemmas of Defense Planning," *Comparative Strategy* 24, no. 4 (2008): 329.

[109] US, Department of Defense, *Quadrennial Defense Review Report – 2006*, (Washington: Department of Defense, 2006), vi.

requirements necessitates an understanding of both the tools used by strategists and military planners as well as their view of the possible future operating environments.

This understanding facilitates capability development. Military commanders then calculate risk by measuring the likelihood of various future scenarios against historical experience and evaluate viable operating concepts. Knowledge of strategic evaluation tools, combined with an understanding of how strategists and Canadian military planners view the likely operating environments, permits forecasting of future engineer mobility capability requirements. Comparison of those results against current doctrine as well as the Canadian Army deployments in 2010, to Newfoundland and Haiti, will reveal likely mobility capability gaps in the Force 2013 force generation structure.

A Strategist's Tools and Description of the Future Operating Environment

The challenge for a strategist is not to predict the exact future operating environment, but rather to prevent planning for the exactly wrong one. Evan Montgomery explains that the unprecedented speed and scale of change in the complex interactions of the modern global reality exacerbates uncertainty.[110] Conventional warfare, counter-insurgency, stability operations - there simply is no consensus amongst strategists on how a military should orient itself for future conflict. Likely operating environments may include transnational terrorists, weak and failed states, rise of near-peer competitors like China, and the proliferation of nuclear weapons.[111] While these descriptions lead one to believe it is impossible to conduct future planning, strategists do offer tools such as strategic contexts and scenario based planning to decipher complex environments.

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[110] Evan Braden Montgomery, Defense Planning for the Long Haul: Scenarios, operational concepts, and the Future Security Environment, (Washington, Centre for Strategic and Budgetary Assessments, 2009), 2 & 5.

[111] Ibid., vii.

Colin Gray explains that, historically, there have been seven strategic contexts, which help rationalize occurrences of conflict. His framework aids in the description and understanding of the inter-actions present in a complex, chaotic global operating environment.[112] Gray's framework helps a strategist and military planner to evaluate all of the relevant factors and assists in the reduction of uncertainty in future planning. A second valuable strategy tool is scenario based planning, which translates strategic challenges into planning scenarios. This tool mitigates uncertainty and encourages the military planner to adapt and innovate when developing solutions to prescribed scenarios.[113] Scenario based planning develops operational requirements. In turn, these operation requirements contribute to the capability based planning process that produces capabilities to combat a wide range of scenarios. In addition to operational requirements, scenario based planning also encourages the development of new military operating concepts to address key challenges that are identified.[114]

New operating concepts change the basic operating framework of military organizations.[115] They influence military effectiveness and the way armed forces convert resources into fighting power.[116] In order to execute an operating concept, a military must be adequately resourced and properly trained. There are temptations to prepare for the last war, and assume the current forces designed for one threat are capable of dealing with all threats. There is

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[112] Colin S. Gray, *War, Peace and International Relations*, (New York: Routledge, 2007), 10. The seven contexts are: the political, socio-cultural, economic, technological, military-strategic, geographical, and historical.

[113] Montgomery, viii & 13.

[114] Ibid., 15.

[115] Allan R. Millet and Williamson Murray, *Military Intervention in the Interwar Period*, (Cambridge: Cambridge University Press, 1996), 306.

[116] Allan R. Millet et al, "The Effectiveness of Military Organizations," *International Security* 11, no. 1, (1986): 37.

also a desire to focus on only one threat, and predict that future wars will always look like the current one.[117]

Former U.S. Secretary of the Army, Robert Gates, believed a balanced strategy combined with a planned military capability that is flexible and adaptable is the best solution to address the myriad of possibilities in an uncertain future.[118] The flexibility and adaptability traits required of the next generation of military operations demand a robust ground mobility capability to maintain military effectiveness in a wide range of disparate operating environments. This engineer capability also meets the strategist's recommendation of a balanced approach and conforms to the Canadian Army's view of the future operating environment.

A Canadian Military Planner's View of the Army of the Future

Military strength, in a Canadian context, is not about the ability to physically dominate others. Rather, it is about making sure that Canadians, their values and interests, are globally respected and sufficiently protected.[119] Unfortunately, military capabilities do not mature quickly. Therefore, you cannot wait to react to an event because it takes time to develop, procure, and train a military capability. Today's military decisions will not parlay into a viable capability for years to come.[120] To force generate capabilities, the Canadian Army must have a view of the future, a planning process to translate requirements of that future view into capabilities, and design an operational approach to employ them.

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[117] Montgomery, 7 & 16.

[118] Robert M. Gates, "A Balanced Strategy: Reforming the Pentagon for a New Age," *Foreign Affairs* 88, no. 1, (2009): 28 and Colin S. Gray, "Coping With Uncertainty: Dilemmas of Defense Planning,", 330. Former Secretary of the Army Gates champions balanced strategy in an article, and Colin Gray recommends flexible/adaptable military postures.

[119] Canada, Parliament of Canada-Senate, *Wounded: Canada's Military and the Legacy of Neglect*, 3.

[120] Montgomery, 1.

The Canadian Army views trends in future conflict similarly to other western allies. The likely threat at home is asymmetrical warfare executed by extremist religious forces with a possibility of conventional threats abroad as the balance of world power shifts.[121] The speed at which conflict transforms into regional crisis requires rapid deployment of a variety of forces in order to address conditions of instability, damaged infrastructure, little economic development, and the need for humanitarian assistance. Canadian Army mobility is critical to resolving these conditions and the competency of the Canadian Military Engineers to provide this capability is essential to success.[122] Non-linear, simultaneous operations with rapid and lethal attacks sustained by just-in-time logistics characterize next generation warfare.[123] The Capability Based Planning process (CBP) uses this Canadian Army view of future conflict to determine the Army's necessary capabilities.

The CBP approach is a transparent process, which traces Canadian Army capability requirements to the demands of national policy.[124] The CF uses eleven planning scenarios to determine missions and tasks. The CBP process uses these missions and tasks to generate capabilities. The measurement of the developed capabilities against the same eleven scenarios assesses their utility and relevance. The predominant belief amongst Canadian military planners is that the Canadian Army should focus more on adaptive forces to meet uncertainty than limited use specialties such as light, medium, and heavy forces.[125] The Canadian Army's statement of

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[121] Canada, Parliament of Canada-Senate, *Turmoil: The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change*, 11.

[122] C-DND, *Land Operations 2021: Adaptive, Dispersed Operations; The Force Employment Concept for Canada's Army of Tomorrow*, (Ottawa: Directorate of Land Concepts and Design, 2007), 6 & 8 and Charles Morrisey, *A CF Strategic Capability Process*, (Kingston, Department of National Defence, 2009), 2.

[123] Morrisey, 3.

[124] Technical Cooperation Program, *Guide to Capability Based Planning*, 10.

[125] Morrisey, 3 & 4.

capability goals ranks the importance of the mobility capability as medium to high. Thus, it should be a substantial consideration in the Army's operational approach.[126]

The Canadian Army uses the CBP process and its view of future conflict to develop an adaptive-dispersed approach to operations for next generation warfare. It requires sufficient capacity to address a wide range of contingencies and is a blending of manoeuvre warfare theory and effects based thinking. Adaptive refers to an agile approach to capability development in terms of both force generation and force employment. The dispersed aspect of operations describes a comprehensive approach where balanced forces disperse in time, space, and purpose. Dispersal also implies substantial force mobility in order to dominate a larger battlespace. [127] The adaptive forces are multi-purpose and operate in a full spectrum environment with integral capabilities. This concept will use modularity through optimized battle groups (BGs). These BGs will be self-sufficient in all aspects and capable of applying military power in adaptive-dispersed operations. The dispersed aspect of operations and the self-sufficiency of optimized BGs provide critical challenges to the provision of mobility and sustainment.

The Commander of the Canadian Army, Lieutenant-General Peter Devlin, recognizes these challenges and understands the need to reinvest in the Army's Combat Service Support (CSS) and mobility resources.[128] The Army of Tomorrow demands precision mobility to execute adaptive-dispersed operations and optimized BGs must be self-sufficient for resources. The

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[126] Technical Cooperation Program, *Guide to Capability Based Planning*, 23. The capability goal expressed as medium at the tactical level and high at the strategic level. High requiring an independent Canadian military capability and medium being fully able to assume leadership roles in effective operation with allies.

[127] C-DND, *Land Operations 2021: Adaptive, Dispersed Operations; The Force Employment Concept for Canada's Army of Tomorrow*, (Ottawa: Directorate of Land Concepts and Design, 2007), 2, 18, & 19; and Lieutenant-Colonel R. Bell, *Land Concept and Capability Development: Army of Tomorrow and Future Army 2040*, (Ottawa: Department of National Defence, 2009), 19 & 21; and Canada, Parliament of Canada-Senate, *Turmoil: The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change*, 16.

[128] Devlin, 45 & 47.

complexity of future conflict will require an engineer with broader knowledge and skills.[129] Centralization of engineer personnel, equipment and resources cannot occur. This severely strains the finite pool of current bridging and road construction resources. The Canadian Army's view of future warfare has undergone capability based planning to propose an operational approach that is beyond the current mobility resources of the Canadian Military Engineers. Due to inadequate resources, the Canadian Senate accused the Canadian Forces of being a "one trick pony" and the recent humanitarian deployments to the Newfoundland and Haiti highlight this claim.[130]

The Recent Past - Haiti and Newfoundland

The Canadian Forces (CF) has a long history of providing support in times of humanitarian crisis. This includes 2010 deployments both domestically, OP LAMA to the province of Newfoundland after Hurricane Igor, and abroad, OP HESTIA to Haiti in response to the massive earthquake. The Disaster Assistance Relief Team (DART) represents the basis of CF contribution to the Government of Canada (GoC) response to disasters. CONOP RENAISSANCE is Canadian Expeditionary Command's (CEFCOM) contingency operational plan for the CF's provision of humanitarian assistance abroad. It will serve as the main plan for discussion.[131] The most recent version of this plan takes into account lessons learned (LL) from 2010 humanitarian assistance (HA) deployments and addressed shortfalls in horizontal construction; however, it still has inconsistencies with respect to bridging.

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[129] C-DND, *Future Force: Concepts for Future Army Capabilities*, (Kingston: Directorate of Land Strategic Concepts, 2003), 164 & 188; and C_DND, *Land Operations 2021: Adaptive, Dispersed Operations; The Force Employment Concept for Canada's Army of Tomorrow*, 24.

[130] Canada, Parliament of Canada-Senate, *Turmoil: The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change*, 16.

[131] CANADACOM has similar domestic CONOPs, which break down plans for each specific type of humanitarian crisis (forest fire, pandemic, flood, hurricane, etc). The concept of the CANADACOM plans is similar to CEFCOM. CEFCOM's CONOP RENAISSANCE is a simpler, more generic plan for discussion.

In CONOP RENAISSANCE, the Chief of Defence Staff's (CDS) intent and strategic centre of gravity (COG) is the readiness and effectiveness of the CF's HA response.[132] The Commander CEFCOM's intent is to ensure the relevance of the CF commitment and his operational COG is mobility support, both in deploying to as well as within the theatre of operations.[133] Within this CONOP, engineers are tasked with providing mobility for the DART. The engineer plan recognizes the importance of integral CSS and includes qualified vehicle technicians for all engineer resources. Furthermore, lessons learned (LL) from OP HESTIA contributed to the increase in horizontal construction capacity from two equipment operators to a complete eight-person section.[134] Yet, by their own admission, engineers are not resourced with manpower or material for bridging.[135] This is inconsistent with their task to provide mobility to the DART force and these shortfalls were highlighted in operational planning for both OP LAMA and OP HESTIA.

OP HESTIA planners very quickly realized the necessity for horizontal construction and bridging capabilities. The author was involved in the initial course of action (COA) development for OP HESTIA and the repercussions of the Army's shortfalls in bridging resources as well as the assumed risk in reduced bridging training was exposed.[136] None of the four engineer regiments in Canada were prepared to deploy and conduct bridging operations without several days of re-training/refreshment of bridging skills. Furthermore, almost all of the CF's stock of serviceable bridging was required for the deployment in order to create an operational pool of

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[132] Canada, Department of National Defence, *CONOP RENAISSANCE – CEFCOM Response to Humanitarian Operations*, (Ottawa: HQ CEFCOM, 2010), 6.

[133] Ibid., 9.

[134] Ibid., EE-3.

[135] Ibid., EE-8.

[136] The Army chain of command acknowledged the risk in reducing bridging and decided to implement the changes regardless. See Chapter 1 for more information.

bridging material. This would leave no bridging assets in Canada for domestic use and would have had disastrous effects on OP LAMA.

As discussed in Chapter 1, the basis of the CF's contribution to OP LAMA was largely a rapid bridging capability to restore connectivity with cut-off communities. Hurricane Igor had destroyed multiple river crossings and isolated thousands or Newfoundland residents in remote locations. 4 Engineer Support Regiment (4 ESR) deployed with only two qualified members to construct the bridges and consumed all of Land Force Atlantic Area's (LFAA) bridging resources. These resources are lost for a period of two years and this operation highlighted the precarious position of the Canadian Army's bridging capability.

OP HESTIA and OP LAMA are just two historical examples of recent CF deployments. They are excellent references to demonstrate the importance of a robust mobility capability to operational forces. The two operations highlight the shortfalls in the current Canadian Military Engineer (CME) capacity to conduct horizontal construction and bridging. They validate the mobility requirements of future adaptive-dispersed forces and stress the significance of a self-sufficient, relevant CME contribution to mobility

Summary of Likely Requirements

The Canadian Army's adaptive-dispersed future operating concept will require precision mobility and modularized BG units, who are self-sufficient. The adaptive nature of this concept will require; agile, multi-purpose, full-spectrum capable, and fully resourced modular BGs. In dispersed operations, these future BGs will require a significant integral mobility capability in order to dominate larger battlespaces. These mobility obligations exceed the capacity of Force 2013's projected engineer capabilities.

The complexity of the future operating environment and the adaptive conditions of the Army's future operating concept demands an engineer with broader knowledge and skills. Likewise, dispersed operations challenge the current methods of centralizing resources to

overcome inadequate quantities of trained personnel, CSS, bridging material and heavy equipment. Recent deployments, on OP HESTIA and OP LAMA, verify the need for well-trained, self-sufficient engineers in the Canadian Army's future concept of adaptive-dispersed operations. Future requirements mandate Force 2013 engineers with a well-rounded knowledge of horizontal construction and bridging. In support of adaptive-dispersed operations, these well-trained engineers must be adequately resourced and sustained to provide mobility support across vast areas of operations.

Conclusion and Recommendations

In the past decade, the Canadian Forces (CF) has exerted significant effort to transform into a relevant 21st century military. The combat evolution of the Canadian Army in Afghanistan occurred despite significant underlying organizational defects lingering from force degradation in the 1990s – its decade of darkness. However, the tradition of short-term, piecemeal procurements and failure to complete the capability development process continues to jeopardize the future Army force. The Force 2013 initiative attempts to re-integrate nine years of Afghanistan operational decisions into an existing force generation structure and transform it towards a future Army goal. An operational assessment of realistic engineer horizontal construction, military bridging capabilities, strategic demands, and likely future requirements exposes a shortfall in the mobility capabilities of the Canadian Army's Force 2013 structure. This monograph asserts that the mobility capabilities of the Army's Force 2013 engineer structure are insufficient to meet the expected future requirements.

This is a result of Force 2013's failure to resolve the realistic shortfalls of the existing force generation structure. Because of the sacrifices required to meet operational force employment timelines, there are three significant mobility shortfalls that the existing Canadian Military Engineer force generation structure will directly transfer into Force 2013's. These shortfalls are horizontal construction and military bridging technical skill erosion in engineer

personnel, the combination of antiquated heavy equipment/armoured engineer vehicles and inadequate bridging resources, and the inability of integral combat service support elements to support engineer mobility operations.

These deficiencies represent a significant risk to engineer core mobility skills and will grow over time. Moreover, the shortfalls exhibit cumulative effects in that inexperienced personnel are more demanding on their equipment and vehicles. Inexperienced operation leads to additional breakdowns on aged equipment, which exacerbates the problems associated with the hollow maintenance organizations within an overwhelmed integral combat service support element. This results in fewer serviceable vehicles available for use by inexperienced operators, thus reducing their training time and continuing the perpetual cycle of decline.

The Canadian Military Engineer's cycle of decline must cease. Canada's military strategy demands excellence at home and leadership abroad. Current Army operating plans and Canadian Forces contingency plans require flexible, responsive, credible, operational ready, and combat capable forces. This necessitates knowledgeable, experienced engineers that are fully resourced and adequately supported in order for the Canadian Army to play a prominent role in domestic emergency situations and the Government of Canada's integrated approach to deployed operations. Furthermore, accepting the status quo as sufficient because it was capable of addressing the last conflict is unsatisfactory. The Canadian Army's vision of the future increases the strain placed on the existing mobility capability gaps as the Army transitions to optimized battlegroups conducting adaptive-dispersed operations in next generation warfare.

Adaptive-dispersed operations will occur in large battlespaces preventing the centralization of engineer resources. The future engineer will require broader knowledge and resource self-sufficiency to provide mobility for tomorrow's Army. These prospective needs will exceed Force 2013's horizontal construction, military bridging, and combat service support capacities. The Canadian Army has cannibalized its force generation structure to meet the demands of operational deployments and jeopardized its long-term health for short-term survival.

Capability re-generation takes time and the Army Commander's prioritization of re-investment in cores skills as his main effort acknowledges this issue. Army support for the Canadian Military Engineer re-investment in its mobility core skills will restore engineer flexibility and technical skills, increase operational readiness and reduce limitations by providing serviceable vehicles/resources with adequate combat service support. This Army support must address the three previously mentioned Force 2013 mobility shortfalls. To resolve these capability gaps, there are near, mid, and long-term recommendations.

In the near-term, Canadian Military Engineers should support the Army Commander's effort to re-orient by restoring pre-Afghanistan foundational engineer training levels in horizontal construction and bridging throughout CFSME's course curriculum. Secondly, Engineers must maintain the priority of Army staff effort on the critical topic list issues of AEV and heavy equipment replacement. Next, a concerted effort must be undertaken to address integral combat service support deficiencies, particularly maintenance, in the Combat Engineer Regiments. Supporting this endeavour should be focused time with combat engineers assisting maintenance technicians to increase overall vehicle serviceability. Finally, the Army should immediately determine sourcing for an operational stock of bridging resources with a view to procurement for domestic use in the mid-term.

The recommendations will address immediate, critical areas of the three mobility shortfalls. The engineer provision of a healthy mobility capability in the future requires continual planning. In the mid-term, the Army should purchase an operational stock of bridging resources for domestic use and source additional bridging for deployed usage. This procurement must include replacements for the quantity of AVLB spans lost in its elimination from the Army's inventory. Additionally, it would be worthwhile to review the decision to abandon heavy equipment operation as a separate engineer specialty. Finally, in the longer term, a review of the need for an under-armour bridging capability and the purchase of deployment stocks of bridging, heavy equipment and AEVs are suggested.

These recommendations assist in rectifying Force 2013's mobility capability shortfalls. It will stop the erosion of the Canadian Military Engineer's preparedness to undertake short notice and/or simultaneous operations. It will ensure that the Army's mobility does not limit Canada's strategic options. Comprehensive capability based planning is at the core of the Army's ability to create effective engineer horizontal construction and bridging capacity that contain a robust mix of well-trained and skilled personnel, reliable vehicles, sufficient resources, and adequate logistics that are working towards a unity of effort. This provides the Canadian Army with superior mobility to generate and project combat power despite its traditional numerical inferiority, thus ensuring Canada's continued relevance on the global stage.

APPENDIX A – Glossary of Acronyms

Acronym	*Meaning*
1 CER	1 Combat Engineer Regiment
4 ESR	4 Engineer Support Regiment
AEV	Armoured Engineer Vehicle
ARB	Air Resources Board
Army CTL	Army Critical Tasks List
ATA	Army Training Authority
AVLB	Armoured Vehicle Launched Bridge
BG	Battle Group
CANADACOM	Canada Command
CBP	Capability Based Planning
C-DND	Canada Department of National Defence
CDS	Chief of Defence Staff
CEFCOM	Canadian Expeditionary Command
CF	Canadian Forces
CFSME	Canadian Forces School of Military Engineering
CIED	Counter-Improvised Explosive Device
CJTL	Canadian Joint Task List
CME	Canadian Military Engineers
COA	Course of Action
COG	Centre of Gravity
CONOP	Contingency Operational Plan
CSS	Combat Service Support
DART	Disaster Assistance Relief Team
DND	Department of National Defence
EOD	Explosive Ordnance Disposal
EROC	Engineer Route Opening Capability
ERP	Equipment Rationalization Plan
FEE Op	Field Engineer Equipment Operator
GoC	Government of Canada
HA	Humanitarian Assistance
HEPO	Heavy Equipment Plans and Operations
HQ	Headquarters
IEDD	Improvised Explosive Device Disposal
IRU	Immediate Response Unit
LFA	Land Forces Area
LFAA	Land Forces Atlantic Area
LFCA	Land Forces Central Area
LFNA	Land Forces Northern Area
LFQA	Land Forces Quebec Area
LFWA	Land Forces Western Area

Acronym	*Meaning*
LL	Lessons Learned
MFR/B	Medium Floating Raft/Bridge
MGB	Medium Girder Bridge
MND	Minister of National Defence
NORAD	North American Air Defence
NSB	Non-Standard Bridge
OP	Operation
P&E/S	Personnel & Equipment/Support
PRICIE	Personnel, leadership, and individual training; Research, development, and operational research; Infrastructure, environment, and organization; Concepts, doctrine, and collective training; Information Management and technology; Equipment and Support
SME	Subject Matter Expert
Sr NCO	Senior Non-Commissioned Officer
TTCP	The Technical Cooperation Program
UOR	Urgent Operational Request
WFM	Whole Fleet Management

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